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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/028,803	12/28/2001	Hiroaki Nakaoka	60188-116	4146

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EXAMINER	
HU, SHOUXIANG	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 02/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/028,803	NAKAOKA ET AL.	
	Examiner	Art Unit	
	Shouxiang Hu	2811	

-- The MAILING DATE of this communication appears on the cover sh et with the correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 November 2003*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *16-32* is/are pending in the application.

4a) Of the above claim(s) *24-32* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *16-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 09/099,195.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Election/Restrictions

1. Claims 24-32 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 8.

Claim Objections

2. Claims 19-23 are objected to because of the following informalities and/or defects:

3. The amendment to the claims filed on November 20, 2003, does not comply with the requirements of 37 CFR 1.121(c) because not all of the added text (such as the last two lines) in claim 19 is underlined. Amendments to the claims filed on or after July 30, 2003 must comply with 37 CFR 1.121(c) which states: The text of any added subject matter must be shown by underlining the added text.

4. In addition, in claim 19, the term of "lattice defects" should read as: --a lattice defect region--; the term of "impurity ions" (line 8) should read as: --the implanted ion--; and the term of "the impurity ions" (line 12) should read as: --the impurity ions of the first conductivity type--.

Appropriate correction is required.

Claim R jections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 19-23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 19 recites the subject matter that the concentration of the implanted ions of the first conductivity type reaches a maximum in a bottom region of the semiconductor layer, but the specification lacks a clear definition about the "bottom region." And, according to the specification and the drawings (esp. Fig. 5), it is the lattice defect region that is in the bottom region of the semiconductor layer, and the concentration maximum of the high concentration region (though it is near the bottom) is actually located above the lattice defect region.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 16-19, insofar as being in compliance with 35 U.S.C. 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 103(a) as being unpatentable over applicant's admitted prior art ("AAPA") in view of

JP'064 (JP 3-32064, 2-12-91; of record) and/or Nandakumar et al. ("Nandakumar"; US 5,917,219).

AAPA (Figs. 11-12e; also see page 1, line 20, through page 5, line 22) discloses a method for fabricating a semiconductor device (SOI MOSFET), comprising the steps of: (a) forming an element isolation film (704) on an SOI substrate including at least an insulator layer (702) and a semiconductor layer (703); (c) forming a gate insulator film (705); (d) forming a gate electrode (707); and (e) forming source/region regions (709 and 710) of a second conductivity type.

AAPA does not disclose that the method can further comprise a step of forming a lattice defect region and a high concentration channel region with impurity ions of Indium. However, JP'064 teaches a method to form an n-channel SOI MOSFET (Fig. 1; also see its English abstract) with a first conductivity type (P-type) heavily doped channel region (33) at/near the entire interface between the semiconductor layer (3) and the insulator layer (2) for absorbing holes so as to improve the breakdown strength. In addition, the method of JP'064 naturally further comprises a step of diffusing and activating the p-type impurities (in region 33) and the n-type impurities (in regions 32 and 31) through a heat treatment in order to enable the device to be functionable normally.

And, one of ordinary skill in the art would readily recognize that a P-type impurity region can be readily and commonly formed through implantation with Indium ions for highly precise and stable doping profiles, as evidenced in the prior art such as Nandakumar (see col. 3, lines 28-34).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate a step of forming a heavily Indium-doped channel region into the method of AAPA, as taught in JP'064 and/or Nandakumar, so that an SOI MOSFET with improved breakdown strength and with desired precise and stable doping profile would be obtained. And, in such a collectively taught method, the Indium heavily doped region would naturally form a high concentration channel region at a region near the bottom of the semiconductor layer and would also naturally form a lattice defect region in the vicinity of the interface between the semiconductor layer (3) and the insulator layer, as each portion of such indium heavily doped region can be regarded as a high concentration channel region (as it would be in proximity to the less-doped channel region) and/or a lattice-defect region (due to the differences in atom sizes).

Regarding claim 18, it is noted that a large single crystal can always be regarded as being formed of multiple small single crystals.

Allowable Subject Matter

9. Claims 20-23 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, and to overcome the claim objections, both set forth in this Office action, and to include all of the limitations of the base claim and any intervening claims.

Response to Arguments

10. Applicant's arguments regarding claims 16-19, filed on November 20, 2003, have been fully considered but they are not persuasive.

Applicant's main argument include: the cited prior art references fail to teach the claimed invention because the JP064 does not teach to form a lattice defects region that covers the entire interface and it fails to disclose the impurity profile, and because Nandakumar fails to form the lattice defect region. In response, insofar as being in compliance with 35 U.S.C. 112 and as being best understood in view of the claim objections above, it is noted that each of the heavily doped regions in JP064 (P+ region 33) and Nandakumar (SSR in Fig. 1) can be regarded as a lattice-defect region, due to the difference in atom sizes between the doped element and the substrate host element. And, the incorporation of a step of forming a heavily Indium-doped channel region into the method of AAPA, as taught in JP'064 and/or Nandakumar, would naturally form a high concentration channel region at a region near the bottom of the semiconductor layer and would also naturally form a lattice defect region in the vicinity of the interface between the semiconductor layer and the insulator layer, as each portion of such indium heavily doped region can be regarded as a high concentration channel region and/or a lattice-defect region. Furthermore, due the nature of implantation process, the doping profile is commonly non-uniform, which naturally has a maximum in a region that can be regarded as being in the vicinity of the interface, given the fact that the SOI type semiconductor layer is commonly very thin.

Conclusion

11. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703)306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9318.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SH
January 28, 2004

SHOUXIANG HU
PRIMARY EXAMINER